

What is claimed is:

1. An image processing apparatus, comprising:
 - a background judgment device judging whether a target pixel is a background pixel using a standard deviation of gray level of pixels in a vicinity area of the target pixel on receipt of a multilevel image.
- 10 2. An image processing apparatus, comprising:
 - a background judgment device judging whether a target pixel is a background pixel using a gray level difference and a standard deviation of gray levels of pixels in a vicinity area of the target pixel on receipt of a multilevel image.
3. The apparatus according to claim 2, wherein the gray level difference is an amount which is calculated based on a difference between an average gray level of white pixels in the vicinity area of the target pixel and an average gray level of black pixels in the vicinity area of the target pixel.
- 20 4. An image processing apparatus, comprising:
 - 25 a background judgment device judging for

each target pixel whether the target pixel is a background pixel on receipt of a multilevel image; and

5 a local binarization device locally binarizing the target pixel, judging which of a background and a stroke the target pixel belongs to, and outputting a binary image if it is judged that the target pixel is not the background pixel.

5. The apparatus according to claim 4, wherein
10 said local binarization device uses an amount which is calculated based on an average and a standard deviation of gray levels of pixels in the vicinity area of the target pixel as a binarization threshold for the target pixel.

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6. The apparatus according to claim 5, wherein the amount which is calculated based on the average and the standard deviation of the gray levels of the pixels in the vicinity area of the target
20 pixel is calculated based on a sum of the average and a constant-multiple of the standard deviation.

7. The apparatus according to claim 5, wherein
the vicinity area of the target pixel is
25 a rectangular area of $N \times N$ with a prescribed number

of pixels N and the target pixel located at a center.

8. The apparatus according to claim 4, wherein
said background judgment device judges whether
5 the target pixel is the background pixel, using a
standard deviation of gray levels of pixels in the
vicinity area of the target pixel.

9. The apparatus according to claim 8, wherein
10 said background judgment device judges whether
the target pixel is the background pixel under
a background judgment condition of $\sigma < \sigma_{\min}$ with σ
as the standard deviation in the vicinity area of
the target pixel and σ_{\min} as a prescribed constant.

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10. The apparatus according to claim 4, wherein
said background judgment device judges whether
the target pixel is the background pixel using a
standard deviation of gray levels and a gray level
20 difference of pixels in the vicinity area of the target
pixel.

11. The apparatus according to claim 10, wherein
said background judgment device judges whether
25 the target pixel is the background pixel under

a background judgment condition of $r = \sigma / \Delta g < r_{min}$ with σ as the standard deviation in the vicinity area of the target pixel, Δg as the gray level difference in the vicinity of the target pixel and r_{min} as a prescribed constant.

12. The apparatus according to claim 10, wherein
10 said background judgment device judges whether the target pixel is the background pixel under a background judgment condition of $\Delta g < \Delta g_{min}$ with Δg as the gray level difference in the vicinity of the target pixel and Δg_{min} as a prescribed constant.

13. The apparatus according to claim 10, wherein
15 the gray level difference is an amount which is calculated based on a difference between an average gray level of white pixels in the vicinity area of the target pixel and an average gray level of black pixels in the vicinity area of the target pixel.

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14. The apparatus according to claim 10, wherein
25 said background judgment device judges whether the target pixel is a background pixel using a combination of a background judgment conditions $\sigma < \sigma_{min}$, $r = \sigma / \Delta g < r_{min}$ and $\Delta g < \Delta g_{min}$ with σ as the

standard deviation in the vicinity area of the target pixel, Δg as the gray level difference in the vicinity of the target pixel and σ_{\min} , r_{\min} and Δg_{\min} as a prescribed constant.

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15. The apparatus according to claim 4, further comprising:

10 a line element restriction device executing a process of the obtained binary image based on a ratio of black pixels in a shape-fixed line element mask including the target pixel and outputting a binary image.

15 16. The apparatus according to claim 15, wherein said line element restriction device leaves the black pixels in the line element mask as black pixels if the ratio of black pixels in the line element mask is a prescribed ratio or more.

20 17. The apparatus according to claim 15, wherein said line element restriction device converts all pixels in the line element mask into black pixels if the ratio of black pixels in the line element mask is a prescribed ratio or more.

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18. The apparatus according to claim 15, wherein
said line element restriction device converts
all pixels in the line element mask into white pixels
if the ratio of black pixels in the line element mask
5 is less than a prescribed ratio.

19. The apparatus according to claim 15, wherein
said line element restriction device uses
a plurality of line element masks.

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20. The apparatus according to claim 4,
further comprising:
a stroke separation device applying a
partial pattern in a gray scale image corresponding to
15 a black pixel joint element in the obtained binary image
and separating strokes of different gray levels.

21. The apparatus according to claim 20, wherein
said stroke separation device judges whether
20 to perform a stroke separation using one of an
inter-class dispersion and a dispersion ratio
between different strokes.

22. The apparatus according to claim 4, wherein
25 said local binarization device judges which

of the background and the stroke a pixel, which is judged to be the background pixel by said background judgment device, belongs to based on a gray level of the pixel.

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23. An image processing method, comprising:

judging for each target pixel whether a target pixel is a background pixel on receipt of a multilevel image; and

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locally binarizing the target pixel, judging which of a background and a stroke the target pixel belongs to and outputting a binary image if it is judged that the target pixel is not the background pixel.

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24. The method according to claim 23, further comprising:

processing the obtained binary image based on a ratio of black pixels in a shape-fixed line element mask including the target pixel; and

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outputting a binary image.

25. The method according to claim 23, further comprising:

binarizing a partial pattern in a gray scale image corresponding to a black pixel joint element in

the obtained binary image; and
separating strokes of different gray levels.

26. A computer-readable storage medium on which
5 is recorded a program for enabling a computer
extracting a stroke included in an inputted multilevel
image to perform a process, said process comprising:

judging for each target pixel whether a
target pixel is a background pixel on receipt of a
10 multilevel image; and

locally binarizing the target pixel, judging
which of a background and a stroke the target pixel
belongs to and outputting a binary image if it is judged
that the target pixel is not the background pixel.

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27. The storage medium according to claim 26,
said process further comprising:

processing the obtained binary image based on
a ratio of black pixels in a shape-fixed line
20 element mask including the target pixel; and
outputting a binary image.

28. The storage medium according to claim 26,
said process further comprising:
25 binarizing a partial pattern in a gray scale

image corresponding to a black pixel joint element in the obtained binary image; and
separating strokes of different gray levels.

5 29. An image processing apparatus, comprising:
input means for receiving a multilevel image; and
background judgment means for judging whether
a target pixel is a background pixel using a
standard deviation of gray levels of pixels in a
10 vicinity area of the target pixel.

30. An image processing apparatus, comprising:
input means for receiving a multilevel image; and
background judgment means for judging whether
15 a target pixel is a background pixel using a gray
level difference and a standard deviation of gray levels
of pixels in a vicinity area of the target pixel.

31. An image processing apparatus, comprising:
20 background judgment means for judging for
each target pixel whether the target pixel is a
background pixel on receipt of a multilevel image; and
local binarization means for locally
binarizing the target pixel, judging which of a
25 background and a stroke the target pixel belongs to,

and outputting a binary image if it is judged that the target pixel is not the background pixel.

32. A transmission signal transmitting to a
5 computer, which extracts a stroke included in an
inputted multilevel image, a program for enabling the
computer to perform a process, said process comprising:

judging for each target pixel whether a target pixel is a background pixel on receipt of a multilevel image; and

locally binarizing the target pixel, judging which of a background and a stroke the target pixel belongs to and outputting a binary image if it is judged that the target pixel is not the background pixel.

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